Center Innovation Fund: AFRC CIF

Plasma Based Energy Deposition for Mitigation of Sonic Boom Experiment to demonstrate viability - Wind Tunnel Test

Completed Technology Project (2017 - 2019)

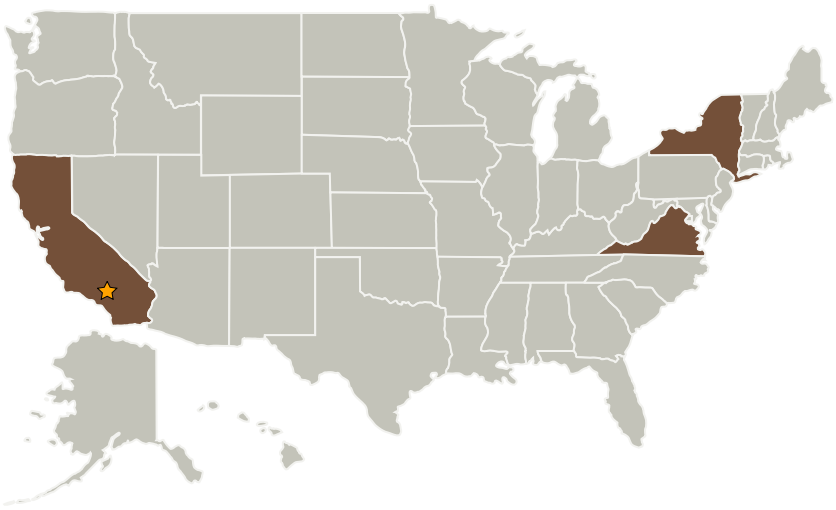
Project Introduction

With regards to plasma generated by electric discharge, we plan to demonstrate the effect of plasma based energy deposition on the strength of the shock waves in the far field by conducting the experiment in flight. Wind tunnel test to confirm that electric discharge on the tip of a 2 diameter model with a magnet in the nose, in Mach 1.6 flow will produce significant shock attenuation

Anticipated Benefits

Acquire far field data to show that the positive effects of plasma based energy deposition via electric discharge extends beyond the near field.\nShow that this is a viable method of sonic boom mitigation worth further in-depth study to investigate full scale implementation. \n If successful, this project will revolutionize commercial supersonic transport as we know it. It has the potential to loosen the current design restrictions on commercial supersonic transport aircraft. Allowing for wider bodied aircraft with improved handling capability at lower speed. It also has the potential to allow for improved control authority during supersonic flight.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★Armstrong Flight Research Center(AFRC)	Lead Organization	NASA Center	Edwards, California
New York University(NYU)	Supporting Organization	Academia	New York, New York

Primary U.S. Work Locations	
California	New York
Virginia	

Project Transitions

October 2017: Project Start

September 2019: Closed out

Closeout Summary: The SPARC project aims to show that the electric arc generated at the nose of a cone-cylinder body in supersonic flow can significantly affect the shock wave generated at the nose of the body in the far field. For this year, we planned to complete the ground testing of our test article and plan and execute a wind tunnel test. However we were unable to achieve the required axisymmetric distribution of plasma at the nose of the model in supersonic flow. This axisymmetric distribution is necessary in order to demonstrate significant shock wave attenuation in the near field. We eventually figured out that the material which we were using as the outer body of our model was preventing the magnetic fields of the magnets inside the models, from propagating to the electric arc at the tip. We were able to change the material and show that we can spin the arc when the model was in stagnant air. However when air was flowing over the model, the arc would no longer spin. We are currently working on determining the requirements necessary for the arc to spin in supersonic flow.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VC

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Armstrong Flight Research Center (AFRC)

Responsible Program:

Center Innovation Fund: AFRC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

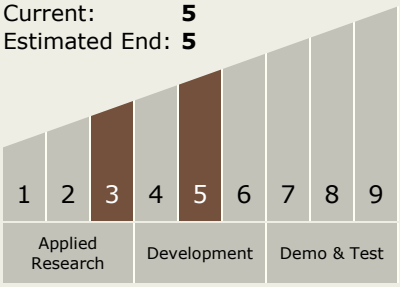
David F Voracek

Principal Investigator:

Aliyah N Ali

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.3 Aero Propulsion
    - TX01.3.8 All Electric Propulsion

Target Destination

Earth